VI. DISCUSSION

A. Cancer Incidence Data

The available data do not suggest that residents of Wayland experienced excessive rates of cancer incidence during the entire time period 1982-1994. Between the years 1982-1994, cancer incidence generally occurred at or below the expected rates in both the town of Wayland as well as in census tracts 3661 and 3662.

In the previous analysis of cancer incidence data in Wayland, during the time period, 1982-1992, there were no statistically significant elevations observed in any of the cancer types evaluated
(MDPH 1997). Furthermore, lung cancer occurred significantly less often among males in the town of Wayland as well as in CT 3662. Although slight elevations in pancreatic cancer among males as well as breast cancer and NHL among females were observed, the elevations were based on small numbers of cases (i.e., less than four cases) and none of these cancer types were consistently elevated across time periods or among both sexes.

During the later time period, 1987-1994, breast cancer occurred more often than expected among females in the town of Wayland as well as in CT 3662. However, this elevation was not statistically significant. Review of staging information at time of diagnosis for breast cancer cases in both the town of Wayland and CT 3662 indicates that the majority of the cases were diagnosed at an early stage (i.e., local) of the disease rather than a later stage (i.e., regional or distant) of disease. In fact, when compared to the state of Massachusetts as a whole, more women in Wayland were diagnosed at an earlier stage of breast cancer (74% diagnosed at local stage in Wayland versus 62% diagnosed at local stage in Massachusetts). These data seem to suggest that Wayland residents use screening and early detection practices more often, resulting in a greater number of breast cancer diagnoses in this area.

Lung cancer among females was slightly elevated in the town as a whole and was statistically significantly elevated in CT 3661, where the Dow Chemical site is located. The distribution of smoking status among female lung cancer cases in both the town of Wayland and in CT 3661 revealed that the majority of cases (i.e., 68%) were current or former smokers at time of diagnosis. Therefore, it is possible that smoking played a role in the incidence of this cancer.

Review of the most recent available cancer incidence data for the year 1995 confirms that Wayland residents do not appear to be experiencing excessive or unusual rates of cancer. There were no statistically significant elevations among any of the fourteen cancer types reviewed for this year. Further, review of geographic location of cases diagnosed in 1995 revealed no apparent spatial pattern of cancer cases in either CT 3661 or CT 3362, nor did it reveal any spatial pattern in the area where the former Dow Chemical site is located.

B. Environmental Data

To determine whether individuals are exposed or could be exposed to contaminants detected onsite at Dow Chemical or possibly migrating from the site, the factors influencing human exposure were evaluated. Exposure pathways are identified as complete or potential. Completed pathways indicate that exposure to a contaminant has occurred in the past, is currently occurring, or will occur in the future. Potential pathways, however, indicate that exposure to a contaminant may have occurred in the past or may occur in the future.

1. Completed Exposure Pathways

Surface Soil (0-3 inches) Pathway

Past exposures were possible to contaminants in the surface soil. Environmental sampling data indicate that some surface soil contamination existed on the site, particularly in the former burn bucket area, the former concrete pad area, and the former shallow disposal area. Because most samples were collected between zero and two feet below ground surface, the

proximity of the contamination to the ground surface (that is, within the first few inches of soil) is unknown. If the contamination is actually below the first few inches of soil, this would present less opportunity for exposure than if the contamination was at the ground surface.

Exposures to surface soil in the past were most likely for workers on the site. However, local residents have been reported walking on the site. Wayland residents used the site to access the walking path that winds through the wooded area. Historically, the site was not fenced and some residents have been reported in the developed area of the site. Therefore, possible exposure routes to surface soil include occasional incidental soil ingestion and dermal contact with the soil.

While there is evidence of non-employee use of the property, the evidence does not suggest that resident use of the site generally would result in significant opportunities for actual exposure. Occasional contact with surface soil could have occurred while walking on the site. However, due
to the industrial use of the site, activities that could result in significant exposure (such as young children contacting the surface soil while playing or older children disturbing the soil while riding dirt bikes) have most likely not occurred on the site.

Although it is possible that some exposure to residents from contaminants in surface soil at the Dow Chemical site may have occurred in the past, the majority of the compounds detected in the site surface soils were at concentrations below the ATSDR comparison value or within typical background concentrations. Although some compounds were detected at concentrations above the ATSDR comparison value, these compounds were found at depths ranging from two to four feet below ground surface. Given the types of activities that reportedly took place at the Dow site, it is unlikely that area residents were exposed to these compounds in the subsurface soil. In addition, some PAHs were detected above the ATSDR comparison value and rural/urban background concentrations. However, these compounds were detected in areas of the site at which soil removal and remedial activities have taken place and therefore do not reflect current site conditions.

Current and future exposures to on-site surface soils are not likely to pose a health threat to area residents. The site is planned for use as conservation land in the future. The types of activities that are expected to take place at the site (e.g., trail walking, hiking) are of low intensity with respect to contact with soils. As a result, the frequency that people will visit the site will be fairly low (e.g., one or two days per week for hours at a time). In addition, Because the site is planned for use as conservation land and because most of contaminated soils on the site were removed during remedial activities, it is not expected that exposure to residual levels of contamination in the soil would pose a health risk.

2. Potential Exposure Pathways

Subsurface Soil Pathway

Although some unknown compounds have been detected in subsurface soil from samples obtained from the shallow disposal area, most compounds were found to be either naturally occurring and/or related to the decomposition of plant material (e.g., pinenes, terpenes, natural waxes, steroids, and
fatty acid compounds) (Gradient 2000). These compounds were detected in samples obtained from a small isolated area of the site, which is heavily wooded, and not easily accessible to the public (Greene 1997). Although local residents have historically been known to visit the site (most often by the footpath which winds through the site), the primary activities that occurred were walking and/ or hiking. In addition, the public is typically only exposed to the top three inches of soil as a result of light recreational activities (i.e., walking, hiking). Due to the inaccessibility of the subsurface soils (i.e., soils found at least two feet below ground surface) to the general public, it is unlikely that local residents have been or would be exposed to site-related contaminants in the subsurface soil. It is possible that, in the past, Dow employees may have been exposed to subsurface soil contamination if they excavated the soil for any reason or disposed of waste below the ground.

Future and current exposure to subsurface soil contaminants could occur during intrusive activities for onsite remedial workers or future excavation or development of the site. The potential exposure routes would be incidental ingestion, inhalation of and dermal contact with subsurface soils. In the future, the site is planned for use as conservation land. As a result, the types of activities that are expected to occur on this property include activities such as trail walking and hiking. There are no current plans to re-develop the site. It is therefore unlikely that people would be exposed to subsurface soils during excavation or development activities in the future. It should also be noted that most of the contaminated subsurface soils found at the site have been removed. Although unlikely, if exposure to residual levels of contamination in the soil did occur, it is not expected that such exposure would pose a health risk.

Air Pathway

No historical environmental sampling data exist to determine whether exposures to contaminants in the air occurred. Therefore, there is insufficient information to accurately characterize possible exposures. Historical records indicate that small volumes (i.e. 100 gallons per year) of volatile solvents were allowed to evaporate up laboratory hoods during normal operations. In addition, employees reportedly burned solvents on-site in the burn bucket area. The former burn bucket area

was located in the northeastern most developed portion of the site and was not adjacent to or near the surrounding residential properties. It is possible that individuals walking on the footpath that winds through this area of the site may have been historically exposed to air particulates via inhalation if burning occurred while they were visiting the site. Dow reportedly engaged in this activity for a limited time period between the years 1964 to 1974. It is not known whether and to what extent individuals frequented the site during these years. It is possible that in the past, an individual(s), who visited the site when burning activities occurred, may have been exposed to airborne particulates as a result of this practice. However, review of employee reports and historical records for the Dow facility

does not indicate that air was a medium significantly impacted by site related activities. In addition, given the nature of the operations conducted at the Dow facility, it is unlikely that the majority of area residents were significantly exposed to air pollutants originating from the former Dow site. Therefore, although environmental sampling data are not available to completely characterize potential exposures, based on known information to date (i.e., employee reports, historical records, and the activities that reportedly occurred at the Dow facility), the MDPH does not believe that this pathway posed a public health hazard for the general population.

In response to community concerns raised at the public meeting held in June 1997, the MDPH obtained and reviewed meteorological data for the town of Wayland from the Northeast Regional Climate Center. Review of cancer incidence data evaluated in relation to prevailing wind data did not suggest an unusual pattern in relation to likely areas of air exposure.

Groundwater Pathway

Past, current, and future exposures to groundwater are unlikely. According to *the Method 3 Risk Characterization*, no public or private water supply wells are located within a one-mile radius of the site (Gradient 2000).

Groundwater sampling from the Willow Brook Farm property, located downgradient from the Dow site, was conducted in 1994 (GZA 1995). The Willow Brook Farm property is located in Wayland, south of and across Commonwealth Road from the Dow site, with its easternmost part in Natick.

This property is served by municipal water. Sampling of five monitoring wells located on the eastern portion of the property did not detect any VOCs or pesticides. According to the *Phase I Site Assessment*, although it is possible that groundwater contamination from the Dow site may impact groundwater at the Willow Brook Farm property, analysis of groundwater samples collected from this area does not suggest that contaminants from the

Dow site have migrated (GZA 1995). Because no potential receptors exist, and because the levels of contamination on the Dow site were below MDEP clean-up standards, the MDEP does not believe that off-property migration of the contaminants will present exposures that would pose a risk (MDEP 1998a).

Therefore, although future exposures to groundwater from the site can not be eliminated, it is highly unlikely that such an exposure would occur. According to the MDEP, the site is not located within a Potentially Productive Aquifer or any other active or potential drinking water source (Ransom 1999a, Ransom 1999c). In addition, the site is not located in or connected to a Zone II drinking water protection area or an interim wellhead protection area (Ransom 1999a). Therefore, there are no pathways such as water supplies, which could be impacted by the limited contamination detected. In addition, groundwater from the Dow site is expected to discharge into the wetland area south of the site. According to the MDEP, given the types of VOCs detected in the groundwater, and their fate and transport properties (i.e., the manner in which they breakdown and travel through the environment), it is very unlikely that they would ever migrate to potential drinking water wells and be present at concentrations exceeding drinking water standards (MDEP 1998a). Furthermore, the source of the groundwater contamination (i.e., contamination in the former shallow disposal area) has been removed from the site. Although uncertainty exists over how long the degradation process may take, contaminant levels in the groundwater, are expected to decrease over time (Ransom 1999b).

Surface Water and Sediment Pathway

As discussed in the Site Description section, three ponds exist on the property. *The Final Preliminary Assessment Report* reported that local children primarily used these ponds (pond name unspecified) for skating and hockey during the winter. Use of the pond(s) for wintertime activities would not typically result in opportunity for exposure unless someone fell in. If an individual
waded or swam in the ponds, exposure to surface water and sediment would be possible. However, based on review of site related historical data as well as anecdotal information

from the community, the ponds were primarily used for ice skating and occasional fishing. It is therefore unlikely that the ponds have been or will be used in the future for recreational purposes that would result in significant exposures. Review of environmental sampling data for the ponds do not suggest that occasional contact with surface water or pond sediment would result in significant opportunities for exposure likely to produce adverse health effects.

Individuals trespassing on the Dow site may have been exposed to the piles of dredged pond sediments if they came in direct contact with these piles (i.e., through dermal contact, incidental ingestion, or inhalation of fugitive dusts). However, based on reports from the community, the majority of individuals who visited the site, used the footpath that winds through toward the woods abutting the property. The MDPH has not received any reports of individuals climbing on or playing in these dredged piles and coming into contact with sediments as a result. Although the MDPH acknowledges that this exposure scenario is possible, based on information reported by the community and other sources, it seems unlikely that area residents took part in this type of activity. However, if such exposure did occur, the maximum detected concentration of the majority of compounds detected in the piles were below ATSDR comparison values and/or MDEP cleanup standards.

Current and future exposures to pond sediments and surface water are unlikely to pose a significant health risk to local residents. Currently, surface water and sediment in the ponds are impacted by low concentrations of SVOCs and metals. In fact, most compounds were detected at concentrations below background and/or below ATSDR comparison values and MDEP standards. In addition, according to a letter requesting that the site be removed from the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) list, the presence of these types of compounds in the ponds is thought to be primarily due to runoff originating from Route 30 (Ransom 2000e, 2000f). In addition, as part of the *Method 3 Risk Characterization*, health risks from swimming and wading in the ponds were calculated quantitatively and compared to MDEPs risk regulations. These risks were calculated for children (the most sensitive population) who may

swim or wade in the North Pond (the most contaminated and the most accessible of the three ponds). Under this exposure scenario, assuming incidental ingestion and dermal contact with both sediments and surface waters, the calculated health risks were below MDEP regulations (Gradient 2000).

Fish Consumption Pathway

Reportedly, in the past, a Dow employee stocked the North Pond with fish. It is not known whether and to what extent Dow employees consumed fish from the pond. Based on review of site related historical data, as well as anecdotal reports from the community, it does not appear likely that local residents regularly (i.e., three or more times per week) used the ponds on the Dow site property for fishing. While it is possible that one or two individuals may have fished in the ponds once or twice a week, this activity alone does not constitute exposure. For an individual to be exposed to contaminants via this pathway, one would need to consume the fish that was caught. Based on review of site historical information and anecdotal reports from the community, consumption fishing did not regularly occur at the Dow site.

C. Child Health Initiative

The ATSDR and MDPH, through ATSDRs Child Health Initiative, recognize that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of their environment. Children are at greater risk than adults from certain kinds of exposure to hazardous substances emitted from waste sites. They are more likely exposed because they play outdoors and because they often bring food into contaminated areas. Because of their smaller stature, they may breathe dust, soil, and heavy vapors close to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if certain toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

According to the Wayland community, children primarily used the ponds at the Dow site for ice skating in the wintertime. Participation in this activity would not result in an opportunity for exposure unless someone fell in. However, review of environmental sampling data does not indicate that exposure to concentrations of contaminants found in surface water or pond sediments would likely to result in health effects. Teenagers were known to use the site as a hangout area. Anecdotal information from the Wayland community suggests that in the past teenagers would drink alcohol near the former concrete pad area. Although this information indicates that teenagers were trespassing on the developed area of the site, the available evidence does not suggest that the reported use of the site would generally result in significant opportunities for actual exposure. Based on these reported uses of the site, activities that could have occurred while walking or hanging out on the site (e.g., incidental ingestion or inhalation of surface soil) do not appear likely to have occurred.

Review of age-specific cancer incidence data for the town of Wayland during the years 1982-1994, and 1995 did not indicate any unusual incidence patterns or increases in cancer incidence among children or teenagers residing in Wayland.

VII. LIMITATIONS

This investigation is descriptive in nature and can only provide a comparison of cancer incidence in census tracts in Wayland with cancer incidence in the state of Massachusetts. Descriptive assessments have certain inherent limitations. Only routinely collected data are analyzed and information about personal risk factors (such as smoking, occupation, and diet) which may influence cancer incidence are often limited and not of an historical nature. Because cancer is a legally reportable disease monitored through the MCR, these data can be evaluated to determine whether cancer is elevated in a specific geographic location. No such registries or statewide monitoring of non-cancer outcomes currently exist where data would be readily available for analysis. Therefore, these types of health concerns could not

be evaluated. It is beyond the scope of this investigation to determine any causal relationships and/or synergistic roles that risk factors may have played in the development of cancers in Wayland.